PRELIMINARY AMENDMENT

Please enter the following amendments to the specification and claims.

IN THE SPECIFICATION:

On page 1, at the end of line 6 delete the period and insert --, now U.S. Patent No. 6,328,482, issued December 11, 2001. --.

On page 1, line 7, insert the following paragraph:

--Priority is hereby claimed to U.S. Provisional Patent Application No. 60/155,915, filed September 27, 1999, entitled Hybrid Microlens Array.--.

On page 5, line 18, at the end of the line please insert -- and --.

IN THE CLAIMS:

Please cancel claims 9-15 and 19-20, without prejudice.

In accordance with 37 CFR §1.121(c)(1)(i), the claim amendments are made by rewriting the claims in clean form herein, and in accordance with 37 CFR §1.121(c)(1)(ii), a marked-up version of the amended claims is attached.

Please re-write the claims as follows:

1. A hybrid microlens, comprising two layers that are transparent at a wavelength of interest, including:

a first layer that has a low index of refraction; fused silica (substrate)

a second layer bonded to said first layer; and

said second layer having an optical focusing element formed on the surface non-adjacent to said first layer, said second layer being substantially thinner and having a higher index of refraction than the first layer, thereby reducing both the microlens sag and the sum of the two layer thicknesses. silicon

2. The hybrid microlens of claim 1 wherein said optical focusing element comprises a refractive microlens.

3. The hybrid microlens of claim 1 wherein said optical focusing element is formed by dry etching.

4. The hybrid microlens of claim 1 wherein said first layer comprises one of fused silica and optical glass.

5. The hybrid microlens of claim 1 wherein said second layer comprises a semiconductor.

6. The hybrid microlens of claim 1 wherein said second layer is comprised substantially of silicon.

7. The hybrid microlens of claim 1 wherein an antireflection layer is situated between the first and second layers, and said antireflection layer is optimized for the refractive indices of said first and second layers.

8. The hybrid microlens of claim 1 wherein said second layer comprises a plurality of trenches that divide said second layer into a plurality of portions thereby providing reduced mechanical stress in the second layer.

16. A method for making a plurality of hybrid microlenses with a first layer and a second layer, said first layer having a lower index of refraction than said second layer, comprising the steps of:

anti-reflection coating one of said first and second layers;

bonding the second layer to the first layer; and

forming a plurality of optical focusing elements on the surface of the second layer non-adjacent to said first layer.

17. The method of claim 16 wherein said optical focusing element comprises a refractive microlens.

18. The method of claim 16 wherein said method of forming said optical focusing elements comprises dry etching.

21. The method of claim 16 further comprising thinning and polishing the second layer after bonding the layers and before forming said plurality of optical focusing elements.

22. The method of claim 16 wherein said step of forming a plurality of optical focusing elements is performed before bonding said first and second layers.

23. The method of claim 16 wherein said step of bonding said first and second layers comprises anodic bonding.

24. The hybrid microlens of claim 1, wherein said first layer comprises a non-perpendicular optical surface formed on a surface non-adjacent to said second layer, said non-perpendicular surface approximately aligned with said optical focusing element.

25. The hybrid microlens of claim 1 further comprising an optical fiber affixed to said first layer, said optical fiber having an end face situated proximate to said first layer, said optical fiber having a core arranged with respect to said optical focusing element to couple light

between said core of said optical fiber and said optical focusing element.

26. The hybrid microlens of claim 25 wherein said first layer comprises a non-perpendicular optical surface formed on the first layer non-adjacent to said second layer.

27. The hybrid microlens of claim 25 wherein said optical focusing element is arranged with respect to said core so that said core is approximately at a focal point defined by said optical focusing element.

A5 (cont'd)

28. A fiber optic collimator for light at a wavelength of interest, comprising:

a first layer that has a low index of refraction and is substantially transparent at the wavelength of interest;

a second layer bonded to said first layer, said second layer being substantially transparent at the wavelength of interest;

said second layer having an optical focusing element formed on the surface non-adjacent to said first layer, said second layer being substantially thinner and having a higher index of refraction than the first layer;

a third layer coupled to said first layer; and

an optical fiber affixed to said third layer, said optical fiber having an end face and a core thereon, said end face situated proximate to said first layer;

wherein said core and said optical focusing element are arranged so that said core is approximately at a focal point defined by said optical focusing element.

29. The fiber optic collimator of claim 28 further comprising an optical epoxy that fills substantially all space between the optical fiber end face and the adjacent non-perpendicular surface, said optical epoxy having an index that approximately matches that of the optical fiber.

30. The fiber optic collimator of claim 28, wherein said first layer comprises a non-perpendicular optical surface formed on a surface non-adjacent to said second layer, said non-perpendicular surface situated between said end face and said optical focusing element so that

optical reflection from said non-perpendicular surface is directed away from said optical fiber.

31. The fiber optic collimator of claim 30 wherein said non-perpendicular surface comprises an approximately planar surface situated approximately at the focal point of said optical focusing element.

32. The fiber optic collimator of claim 28 wherein said optical fiber defines a longitudinal axis and the end face is non-perpendicular to said longitudinal axis.

AS (cont'd)

33. A method for making a plurality of fiber optic collimators, comprising the steps of:

providing first and second layers that are substantially transparent at a wavelength of interest;

anti-reflection coating one of said first and second layers;

bonding the second layer to the first layer so that the anti-reflection coating is between said first and second layers;

forming a plurality of optical focusing elements on the second layer; and

affixing a plurality of optical fibers to said first layer, including aligning said optical fibers respectively with said optical focusing elements, so that the end face of each of said optical fibers is approximately aligned with the focal point of its respective optical focusing element.

34. The method of claim 33 wherein said optical focusing element comprises a refractive microlens.

18

35. The method of claim 33 wherein said step of forming a plurality of optical focusing elements is performed before bonding said first and second layers.

36. The method of claim 33 wherein said method of forming said optical focusing elements comprises dry etching.

37. The method of claim 30 further comprising a method for substantially reducing an optical return signal from an optical fiber, comprising:

forming a plurality of non-perpendicular surfaces on said first layer, each of said non-perpendicular surfaces arranged to be between one of said optical fibers and its respective optical focusing element.

A5 (cont'd)

38. The method of claim 37 wherein the step of forming non-perpendicular local surfaces comprises dry etching.

39. The method of claim 33 further comprising forming an angle on the end faces of said optical fibers.

40. The method of claim 33 further comprising the step of filling substantially all space between said optical fiber and said non-perpendicular local surface with an optical epoxy having an index of refraction that approximately matches that of said optical fiber.